What is claimed:

1. A method for producing compound semiconductor quantum particles from at least a metallic element selected from Groups IB, IIA, IIB, IIIA, IVA, and VA of the Periodic Table and at least a non-oxygen reactant element selected from the group consisting of P, As, S, Se, and Te, said method comprising the steps of:

(a) mixing a first precursor composition comprising said at least a metallic element with a second precursor composition comprising said at least a reactant element to form a reacting fluid comprising nanometer-size compound semiconductor clusters being precipitated out of a liquid medium;

(b) operating an atomizer means to a break up said reacting fluid into micron- or nanometer-size fluid droplets, each said fluid droplet containing a predetermined, but small number of said nanometer-size compound semiconductor clusters dispersed in said liquid medium for the purpose of constraining the growth of said clusters;

(c) directing said fluid droplets into a material treatment means to further separate and/or passivate said clusters to form said compound semiconductor quantum particles; and

(d) drying and collecting said quantum particles.

2. The method as set forth in claim **1**, wherein said compound semiconductor quantum particles comprise particles of phosphide, arsenide, sulfide, selenide, and/or telluride.

3. The method as set forth in claim **1**, wherein said atomizer means comprises a vortex atomizer and/or ultrasonic atomizer .

4. The method as set forth in claim **1**, wherein said material treatment means comprises

(C1) means for directing said fluid droplets into a flocculent liquid;

(C2) means for removing said liquid medium;

(C3) means for vaporizing said liquid medium;

(C4) means for capping said clusters with an organic or inorganic capping agent; and/or

(C5) means for reacting said clusters with a coating agent to form a protective layer on the

surface of said clusters.

5. The method as set forth in claim **1**, further comprising a step of doping said particles with predetermined dopants.

6. The method of claim **1**, wherein the sub-step of passivating said clusters comprises contacting said clusters with a volatile capping agent selected from the group consisting of ammonia, methyl amine, ethyl amine, acetonitrile, ethyl acetate, methanol, ethanol, propanol, butanol, pyridine, ethane thiol, tetrahydrofuran, and diethyl ether.

7. The method of claim **1**, wherein said compound semiconductor clusters have an average particle size of from about 1 to about 20 nm.

8. The method of claim **1**, wherein said compound semiconductor particles are selected from the group consisting of $Cu(In_{1-x}Ga_x)Se_y$, where x is 0-1 and y is 1 or 2, CdS, ZnSe, ZnS, ZnTe, PbSe, PbS, and PbTe.

9. The method of claim **1**, wherein said first precursor composition is selected from the group consisting of metal halogenides, metal sulfates, metal nitrates, metal phosphates, complex metal salts, metal alcoholates, metal phenolates, metal carbonates, metal carboxylates, and metallo-organic compounds.

10. The method of claim **1**, wherein said liquid medium comprises a solvent selected from the group consisting of methanol, ethanol, propanol, butanol, diethyl ether, dibutyl ether, tetrahydrofuran, butoxyethanol, ethyl acetate, pentane, hexane, cyclohexane, and toluene.